Accessibility

Overview

Accessibility means developing a user interface that takes the needs of users with disabilities into account. Approximately 40 million Americans have some type of disability. Many countries have laws that mandate accessibility at some level.

Accessibility is, by definition, a category of usability: If the user interface is accessible, it will also be more usable for everyone. There are two distinctions when discussing accessibility.

- Direct access - the interface is developed with accessibility in mind, making the interface more usable to users with mild to moderate disabilities without the need for assistive devices. Examples include keyboard shortcuts and visual cues that augment audible cues.

- Assistive access - the system supports specialized software and hardware that aid users with disabilities. For example, specialized input and output capabilities, such as screen readers, on-screen keyboards, and head-mounted pointers, assist people who are visually impaired, or have difficulty controlling a mouse.

Most major software developers, including Microsoft, Apple, and Sun, support accessibility features required by popular assistive technology. In general, if developers use standard controls and follow simple guidelines in designing software applications for Windows or the Web, the resulting software will be accessible.

Legal Considerations
In the United States, addressing issues of accessibility is a requirement in current federal contracts. Similar considerations exist in the commercial sector. The following laws and statutes address these issues:

- The Assistive Technology Act of 1998 (ATA)

- The Individuals with Disabilities Education Act of 1997 (IDEA'97)

- Human Factors and Ergonomics Society (HFES) and American National Standards Institute (ANSI) guidelines
- The United Kingdom's Disability Discrimination Act
- European Community ISO 9000 legislation

In the United States, there are three laws that specifically cover accessibility in software applications:

- The Americans with Disabilities Act - all businesses with 15 or more employees must make reasonable accommodation for employees or potential employees with disabilities. This act entitles individuals to sue their employers or prospective employers if the software they use is not accessible. This act was interpreted to also require commercial Web sites to be accessible.
- Section 508 of the Rehabilitation Act - has a similar effect on the government and any organization receiving federal funding. New legislation is in the works to strengthen enforcement of these requirements. The Federal Government is the single largest purchaser of computer software.
- Section 255 of the Telecommunications Act - requires hardware and software manufacturers to ensure that products are usable by individuals with disabilities, or compatible with existing accessibility aids commonly used by individuals with disabilities to achieve access. This may apply to any hardware or software that transfers information over the Internet, a network, or phone lines.

General Accessibility Standards for Direct Access

The following accessibility standards are to be adopted across all CDC Windows software applications and web-based surveillance applications using HTML. These standards apply to all CDC surveillance user interfaces designed to accommodate both direct access and assistive access. These standards should lead to a more consistent and usable interface.

Provide clear and precise documentation on all accessibility features.
Since most software is mouse-driven, it is not always clear how to access functions using the keyboard. Without documentation, the user cannot use the software by means of the keyboard alone. Documentation should include menu access, keyboard navigation, and keyboard shortcuts. It is not necessary to document the keyboard access for those functions that already follow documented operating system conventions.

Provide keyboard access to application functions.
Keyboard access is essential for users with physical and visual disabilities who cannot use a mouse. Make sure keyboard access is provided to all active objects such as menus, buttons and scroll boxes. Provide keyboard equivalents for all mouse actions following documented operating system conventions. Define accelerator, mnemonics or shortcut keys for tasks that are frequently performed, for example *Ctrl+P* for print and *Escape* for cancel.

Do not conflict with key mappings reserved for accessibility features built into the operating system.
Most operating systems have a set of accessibility options that enable users to customize their setup for the keyboard, display, sound and the mouse. For example, someone with a motor disability may not be able to press multiple keystrokes simultaneously. Setting the Sticky Keys option enables the user to press the keys one at a time (e.g., Ctrl-Alt-Delete). Someone who is deaf or hard-of-hearing would need to set the Sound options so they get visual cues or captions for audio information. These features make it possible for people with a variety of disabilities to use their computer. If the software interferes with these options these users may find their system unusable.

Position related objects near each other.
Assistive technologies (screen readers and screen magnifiers) use proximity to help their users understand the identity and purpose of objects. Grouping related items makes forms or dialogs easier to comprehend and execute. This not only improves accessibility for users with disabilities, but improves the usability for all users. Some examples of grouping include:

- Group items by function or logical association. For example, Street, City, and State/Territory can be grouped together under the heading "Address."
- Order elements by their sequence or use. For example, in an ordering application, group the items in the order they would be entered.
- Order objects by importance with the most important fields at the beginning of the group.
- Use sections to organize data into meaningful groups.

Provide a logical and meaningful tab order between interface elements such as buttons and lists.
A logical keyboard navigation order should be used to ensure that dialog boxes and groups of objects can be accessed in a logical order using the keyboard (normally from left to right and top to bottom in Western languages). If the order does not follow this convention, it can be very confusing to users who navigate using the keyboard. It is especially confusing for people who are blind and rely on screen readers. Users who are blind explore a dialog box sequentially, instead of scanning the entire box as sighted users would. Random tab order can make the dialog box nearly unusable (refer to Navigation and Metaphors section of this style guide).

Use color and graphics redundantly with text.
Do not convey important information by either color or graphics alone. If the software conveys information by color alone, users who cannot identify or distinguish colors will not be able to make use of the information. For example, highlighting a required field in red is not useful if the user cannot distinguish the red field from other fields on the screen.

Select colors that can be easily distinguished by people with color blindness.
About 8 percent of men and .4 percent of women have trouble distinguishing red and green. Avoiding red-green distinctions removes the problem for most people. Unless all users have been screened for color weakness (blindness), you can't depend on the user's ability to see colors. When in doubt, view the screen in gray scale. If the color values are easily distinguished in gray scale, they will be visible to people who have a problem with color blindness (refer to the Color section in this style guide).

Ensure high contrast by using only colors that can be cumstomized through the Accessibility Settings for High Contrast in the Control Panel.
Color is a matter of preference for many people, but it is critical for many users with visual impairments. Many people require a reasonably high contrast between text and the background to be able to read. They may even need a particular scheme, such as white text on a black background, to prevent the background from "bleeding" over and obscuring the foreground text. Use only colors that the user can customize through the Accessibility Settings for High Contrast in the Control Panel. (Note: Accessibility must be opted ON when installing Windows.)

Use system settings for font, size, color and all other user interface controls.
Some people like to set preferences for font, size and color and for all other user interface controls. People with disabilities may need to set these preferences. All CDC surveillance applications must support those settings and should never override the users selections.

Provide a zoom function that allows the user to increase or decrease magnification of client area content..
Many individuals who do not consider themselves to be disabled want to "view" a document or an application work area in an enlarged font while not affecting the actual document or work. For individuals with acknowledged visual impairments, the ability to zoom the application work area to 150%, 200% or greater may make the difference between being able to use the application or not. The vast majority of individuals who need this kind of access do not use screen magnifiers.

Provide an option to adjust timed responses or allow the response to remain on the screen until the user closes it.

Some users have difficulty reading or responding to information if it is displayed briefly or requires a quick response time. Some response delays may also be caused by the use of assistive technology used to read the screen or by the use of tools that magnify only a portion of the screen. If timed responses are required, provide an option to adjust the response time. It should be adjustable to at least 5 times the average response time. Alternatively, do not have timed responses for important messages. Rather, display the message until the user closes it.

Disable screen flashing or rapid updates.

Provide an option to either slow down or disable rapid screen updates or flashing. Rapid screen updates can cause epileptic seizures in susceptible individuals. This includes flashing text or graphics on and off or repeatedly changing between different images on the screen.

General Accessibility Standards for Assistive Access

The following accessibility standards are to be adopted across all CDC Windows software applications and web-based surveillance applications using HTML. These standards apply to all CDC surveillance user interfaces designed to accommodate assistive technologies. These standards should lead to a more consistent and usable interface.

Provide a well defined visual focus indicator that moves among interactive objects as the input focus changes.

Even if the software provides keyboard access as a method for navigating through the application, users must still know where they are. Keyboard users must be able to see the current focus point to know what to do. Imagine typing if you could not see where the data will be inserted. Assistive technology (e.g., screen readers, screen magnifiers) needs to know the position and contents of the visual focus indicator, so it can describe, magnify or manipulate the object for the user. As a blind user moves the focus with the arrow keys, a screen reader must know the position of that focus so that it can echo the current character, word or line. Similarly, as a user tabs around a dialog, a screen magnifier can follow the visual focus. The easiest way to provide object focus in Windows software is through the use of standard Windows controls. When you use standard Windows controls no additional work is required to provide visual focus.

Provide sufficient information about user interface objects so that assistive technology can understand how the objects are used.

Users who are blind use computers with the aid of assistive technology such as screen readers or Braille displays. The assistive software must provide information about the objects so a screen reader can tell its user what the focus

object is as well as its role and state. For example, if you tab through a form and focus is on a radio button object, you need to know it is a radio button and whether it is checked or not. The easiest way to provide object information in Windows software is through the use of standard Windows controls. No additional work is required for standard Windows controls.

Associate labels clearly and programmatically with controls, objects and icons.

The labels must be associated with the object in order for the assistive technology to make them available to the user. Do not have multiple objects with the same name on the same form or dialog if they do not perform the same function. There are several ways to accomplish this:

- Place text labels for objects immediately to the left or immediately above the control. Screen readers use proximity to identify labels if they are not exposed programmatically. (Refer to Controls section of this style guide.)
- Use the standard Windows tooltip control to apply a label to each image.
- Use Microsoft Active Accessibility (MSAA) programming interface to expose the name and description of each image.

Provide an option to display a visual cue for all audio alerts.

Users may not be able to hear or distinguish sounds if they are deaf or hard-of-hearing, work in noisy environments, or turn off sounds to avoid disturbing others. In order for these users respond to the audio alerts, those alerts must be presented visually as well. Typical alerts might be the receipt of new mail, beeps to indicate system errors, or sounds to indicate a change in status. System alerts are signaled to a deaf or hard-of-hearing user with the SoundSentry feature in the Windows operating system. This provides a generic visual indicator when the software makes a noise. SoundSentry requires no special coding on the part of application developer. Other ways to alert users to sounds include:

- Flash the title bar of the window that is receiving the alert. Display a message box for the alert.
- Display a status indicator on the notification area of the taskbar that flashes when initially displayed to attract the user's attention.
- Place a text message in a status window.

Provide a transcript or description of important audio or video clips.

For those who are deaf or hard of hearing, audio content is not accessible. Videos without descriptions are not accessible to the blind. In both cases the information needs to be provided in an alternative format. Important information contained in audio or video needs also to be available in text. A transcript is a word-for-word textual version of the audio. The user should be given the choice of reading the transcript or listening to the audio. The "description" is longer and more significant than the "transcript". The "audio description" needs to be available in text form. The video description should be available in both text and audio form. The description can be both subjective and artistic, depending on the intentions of the author. The descriptions and transcripts can be on the same page, on a

separate page, or on a page with a listing of the descriptions of all significant clips on that site. The current convention is to place a hyperlink to the transcript and description near the clip itself.

General Accessibility Guidelines

The following guidelines have been established within the Windows user interface design community and should be applied across CDC software applications and web-based surveillance applications.

Include people with disabilities in the design process.
Consider the needs of people with disabilities in all stages of the design process, including requirements gathering, task analysis, usability testing, and when establishing application design standards and guidelines.

Test all CDC surveillance software under simulated disability conditions.
Testing under simulated disability conditions does not realistically represent the varied contexts and needs of users with disabilities, but it is better than not testing accessibility at all.

- Test with the High Contrast option and High Contrast appearance schemes.
- Test compatibility with extra-large appearance schemes.
- Unplug the mouse and ensure that all features can be used without a mouse through standard, documented methods.
- Test with the Inspect Objects tool and with the Microsoft Windows Narrator accessory to verify that all screen elements are exposed and properly labeled.
- Test with the Microsoft Magnifier to verify that the keyboard focus location is properly exposed during navigation and editing. This accessory is included with Microsoft Windows 98 and Microsoft Windows 2000 operating systems, and in the Microsoft Active Accessibility Software Development Kit.
- Test with changes to the system font size and number of pixels per logical inch using the Display Settings option in Control Panel.

Test all CDC surveillance software with disabled users.
Usability testing with even one user from each of the general disability categories can provide significant benefits for all users, not only those with disabilities. Low vision users are sensitive to font and color conflicts, as well as problems with layout and context. Blind users are affected by poor interface flow, tab order, layout, and terminology. Users with physical disabilities that affect movement can be sensitive to tasks that require an excessive number of steps, wide range of movement, or small icons. Usability testing with disabled users can uncover usability defects that can affect all users.

Evaluate the usability of all CDC surveillance software using popular assistive technologies.

Test with commercial accessibility aids. For a list of these aids, see http://www.microsoft.com/enable/products/aids.htm. There is also a short list and explanation of Helpful Tools at the end of this section.

HTML Specific Standards

The following standards are to be adopted across all CDC web-based surveillance applications using HTML. These standards are intended to lead to a more consistent and usable interface.

Make links descriptive

Use descriptive link text that makes sense when it is read out of context. Users who are blind will often scan through a list of links in a document to understand the layout and options on the page. Links that say "go" or "click here" do not make sense out of context. Link text should be descriptive, more than "click" or "here", without being so wordy that it interferes with efficient browsing. Several browsers for voice navigation, as well as screen readers, now list the links separately.

Place a dividing character between links which occur consecutively.

Vertical bars or graphics can be used to prevent a list of links from being read as one link by a screen reader.

Provide short, descriptive ALT-TEXT descriptions for all graphics, including decorative graphics.

Text browsers and screen readers cannot convey images to their users. To compensate, it is important to associate alternative text with all images, especially for images that are links or buttons. The alternative text should be meaningful, like "home page" or "search" or "products." When images are not links, use alternative text carefully. A person having to listen to a page cannot ignore text the way a person viewing the page can ignore an image. If images are not important or if they are redundant, use alt="", telling the text browser to ignore the image. The use of alternative text is not just for people who are blind. Alternative text is also used by voice recognition software. Links that are images are not accessible to voice recognition software unless the author has provided alt text for the image. The user, navigating the Web with voice recognition, can say "click home page" for the image whose alternative text is "home page."

Summarize the content of each graph and chart or use the longdesc attribute to link to the description or data .

A chart or graph is essentially an image with detailed information. Text browsers and screen readers cannot convey images to the user, so you need to provide a text equivalent of the graphical information. Use one of the following techniques:

- Include the description in the textual content.

- Use a "D-Link" with a URL containing the description.
- Use the long description attribute: longdesc="longd.html"

Provide ASCII text or HTML for all documents presented in frame, PDF, PostScript or other formats.

Many users employ assistive devices that can only read text in ASCII or HTML. PDF documents are readable by web users using access technology with the help of 'Access Adobe'. Access Adobe translates PDF into HTML, making it readable if you are unable to access PDF in the usual way. If you offer PDF files on your site, ensure that a link to http://access.adobe.com is available.

Always provide a NOFRAMES alternative for people who cannot read framed information.

Some assistive devices cannot make sense of frames, so always provide an alternative to frames and specify NOFRAMES in the HTML.

Always offer text versions of any content for which a plug-in is required.

Many people cannot download plug-ins such as Shockwave, Flash, and Java applets easily. Where possible, provide alternate content for scripts, applets, and plug-ins so that important information is not lost when those features are unsupported or turned off.

Always associate labels with form elements.

It is important for the labels, like "Last Name," to be clearly and programmatically linked with the corresponding element in a form, in this case an text input field. When the labels are explicitly associated with the form elements through HTML, assistive technologies can present the information meaningfully to a person who is blind. Some form controls, such as submit buttons, automatically have labels associated with them, but most do not (text fields, checkboxes and radio buttons, and menus). If a label is immediately to the left of a form control or immediately above the element, then assistive technology will usually be able to convey the intent as conveyed by proximity. HTML 4 provides specific markup, the LABEL element, to connect the form element and its label.

Provide methods for skipping over navigation links to get to main part of a page.

When a navigation bar appears at the top of a page and/or down the left side of the page, users who are reading the page with speech synthesis must listen to all of those links across the top and down the left for each page they visit before they get to the main content. Users who are sighted ignore the links and go right to the main content. A simple technique is to display a "skip navigation" link at the top of the page. If there are several sections of main content, then have a series of links, for example, "skip to headlines," "skip to sports," and "skip to business."

Construct tables with access in mind.
Tables pose major problems for some users. Users with normal vision can quickly scan through a table and get a general idea about the data it. People who are blind cannot. Screen readers tend to read across the screen in a way that runs all of the text on a line together. If an entry in a cell occupies more that one line the first line of each cell would be read, then the second, and so on. If a person is using speech syntheses, it can be very difficult to understand the table information. The CAPTION element and the summary attribute on the TABLE element provide information to people who are blind or have low vision. The CAPTION element provides a technique for displaying a title for a table. The summary attribute on the TABLE element provides a description of the contents of the table. If tables are used to format text on your site, consider using BETSIE (http://www.bbc.co.uk/education/betsie/) to reformat your pages for people using screen-reading software.

HTML Specific Guidelines

For web based applications using HTML, the following guidelines are recommended and should be applied across CDC web-based applications using HTML.

Provide an alternate text-only page which translates all of the graphic and text into text only.

Wherever Javascript is used, provide alternative pages which are Javascript-free.
Javascript can present problems. Some of the software that blind people use cannot read Javascript and may only tell the visitor that there is "an unsupported script" on the page.

Avoid non-standard HTML formats, special tags, etc.
Non-standard formats and tags often cause problems for Braille translation, screen readers and some browsers.

More on Disabilities

The following disabilities can make using computers challenging.

Visual impairments.
From low vision to blindness, the range of visual limitations is broad. Symptoms of low vision include dimness, haziness, extreme far-sightedness or near-sightedness, color blindness, and tunnel vision, among others. People with these disabilities are concerned with being able to see text or images on a computer screen and being able to perform tasks that require eye-hand coordination, such as moving a computer mouse. Text size and color can make a big difference in legibility for people who have low vision.

Movement impairments.

Mobility impairments can be caused by arthritis, stroke, cerebral palsy, Parkinson's disease, multiple sclerosis, and loss of limbs or digits, among others. Poor muscle control or weaknesses can make using standard keyboards and mouse devices difficult. For instance, some people are unable to type two keys simultaneously, while others tend to hit multiple keys or to bounce keys when pressing or releasing them. People who are able to use only one hand likewise have difficulties with some keyboard and mouse tasks.

Hearing impairments.
People with hearing impairments may be able to hear some sound, but may not be able to distinguish words. Other people may not be able to hear sound at all. Not being able to hear computer prompts, like beeps and spoken messages, can be problematic for these individuals.

Cognitive and language impairments.
Cognitive and language impairments range from dyslexia to difficulties remembering, solving problems, or perceiving sensory information to problems comprehending and using language. For people with these impairments, things like complex or inconsistent displays or word choice can make using computers more difficult.

Seizure disorders.
Specific patterns of light or sound can trigger epileptic seizures in some susceptible individuals.

More on Assistive Technologies

Screen enlargers
help people with low vision. Also called screen magnifiers or large print programs, these utilities are like a magnifying glass. People using them are able to control what area of the computer screen they want enlarged, and can move that focus to view different areas of the screen.

Screen reviewers
are for people who are blind. These aids make on-screen information available as synthesized speech or a refreshable Braille display. Also called blind access utilities or screen readers, they can only translate information that is text. Graphics can be translated if there is alternative text describing the visual images.

Voice input aids
assist people with mobility impairments. Also called speech recognition programs, these enable people to control computers with their voice instead of a mouse or keyboard.

On-screen keyboards

are used by people who are unable to use a standard keyboard. An on-screen keyboard lets people select keys using a pointing method such as pointing devices, switches, or Morse-code input systems.

Keyboard filters
are used by people who have trouble typing, or who want to increase typing speed. The filters built into the Windows and Windows NT operating systems compensate somewhat for erratic motion, tremors, slow response time, and similar conditions. Other types of keyboard filters include typing aids, such as word prediction utilities and add-on spell checkers.

Alternative input devices
allow individuals to control their computers through means other than a standard keyboard or pointing device.

Recommended Readings

Chisolm, Wendy, Neal Ewers, and Gregg Vanderheiden, *Design of HTML Pages to Increase their Accessibility to Users with Disabilities*, 1999

The Windows Interface Guidelines for Software Design. Microsoft Press, 1995
Chapter 14 - Special Design Considerations

Helpful Web Sites

National Center for Accessible Media
http://www.boston.com/wgbh/ncam/

Bergman, Eric (SunSoft) and Earl Johnson (Sun Microsystems), *Towards Accessible Human-Computer Interaction*, "Advances in Human-Computer Interaction" Volume 5, Jakob Nielsen, Editor, Ablex Publishing Corporation, 1995
http://www.sun.com/tech/access/

"EITACC Desktop Software standards": Electronic Information Technology Access Advisory (EITACC) Committee.
http://trace.wisc.edu/docs/eitacc_desktop_software_standards/desktop_software_standards.htm

"Requirements for Accessible Software Design": US Department of Education, Ver 1.1, March 6, 1997.
http://ocfo.ed.gov/coninfo/clibrary/software.htm

"Java accessibility guidelines and checklist":IBM Special Needs Systems. This site contains detailed guidelines for the Java environment.
http://www.austin.ibm.com/sns/accessjava.html

"Windows accessibility guidelines": Microsoft. This site contains detailed guidelines specific to the Microsoft Windows software environment.
http://www.microsoft.com/enable/dev/guidelines.htm.

"Web accessibility guidelines and checklist": IBM Special Needs Systems. This site contains detailed guidelines for the Web and HTML.
http://www.austin.ibm.com/sns/accessweb.html

Helpful Tools

Bobby
Bobby is a web-based tool that analyzes web pages for their accessibility to people with disabilities. The Center for Applied Special Technology (CAST) offers Bobby as a free public service in order to further its mission to expand opportunities for people with disabilities through the innovative uses of computer technology. To analyze your web site, type in the URL of the page that you want Bobby to examine and click Submit. Bobby will display a report indicating any accessibility and/or browser compatibility errors found on the page. Once your site receives a Bobby Approved rating, you are entitled to display a Bobby Approved icon on your site. For more information, visit the Bobby web site at http://www.cast.org/bobby/.

BETSIE
BETSIE stands for BBC Education Text to Speech Internet Enhancer, and is a simple Perl script which is intended to alleviate some of the problems experienced by people using text to speech systems for web browsing. For more information, visit the BETSIE web site at http://www.bbc.co.uk/education/betsie.

Object Inspector
Object Inspector is an application provided by Microsoft as part of the Software Development Kit (SDK) for Active Accessibility. Inspector can be used to validate the aspects of accessibility of software user interface elements which use Microsoft Active Accessibility (MSAA) or standard windows controls. It supports software written for the Windows 9x, Windows NT or Windows 2000 platforms. Object Inspector can be downloaded as part of the Microsoft Active Accessibility SDK. There is no charge to download and use the SDK.

Magnifier
Magnifier is a Windows tool that allows you to magnify a portion of the screen that is then displayed in a separate magnifier window. Magnifier tracks the focus so it can automatically keep the active area in the magnifier window. Magnifier is available from Microsoft as part of the Software Development Kit (SDK) for Microsoft Active.

Microsoft Active Accessibility (MSAA)
Microsoft Active Accessibility is a developer technology that improves the way programs and the operating system work with assistive technology. Using Active Accessibility, software developers can make their programs more compatible with assistive technology, and assistive technology developers can make more reliable and more robust tools. You can find out more about MSAA by visiting http://www.microsoft.com/enable/msaa/default.htm.